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# THE NEW PHILO POWER PLANT

BY REED D. ACHAUER '24

**P**HILO, (or Taylorsville, as it used to be called) is situated in the eastern part of Ohio, in the historic and picturesque Muskingum River Valley, ten miles down the river from Zanesville. It is here that The Ohio Power Company is building a large electric power plant which will be one of the largest in the country.

Before deciding upon a location, a survey was made over very nearly the whole length of the river, starting at the mouth, which is at Marietta, and working back up stream. This was a general hydrographic survey which included finding the low and high water records at the various dams along the rivers as far back as the records had been kept, and also the temperature changes of the water.

Several locations were considered, but the Philo site seemed particularly suitable in that there is a large crescent-shaped island formed by the river on the one side and an old unused canal on the other. The river makes a big bend here and back in the early part of the 18th century a canal was put thru which cut off this bend, and formed what has ever since been called an island, though it is not one in any sense of the word. This canal has long since been out of use and was grown over with bushes, weeds and small trees. There were old locks at the south end of the canal, the ones at the north end having been taken out when the present-day ones were constructed. The boats now go right thru the new locks at the north end of the canal into the river. The island is about a mile long and 1000-ft. wide at the widest part.

A very thorough hydrographic and topographic

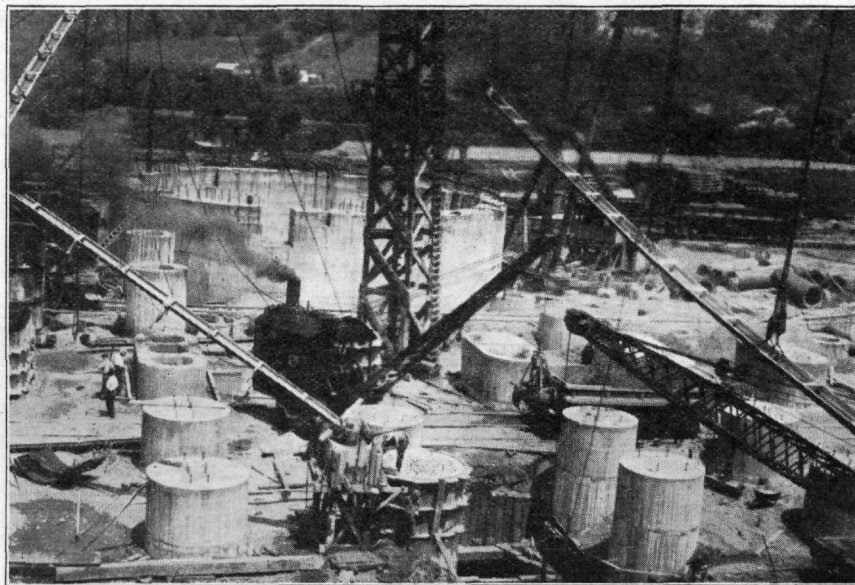
survey of this site was then made, the hydrographic survey being under the supervision of the Fargo Engineering Company, well known hydraulic engineers. A number of drill holes were sunk on the island to determine the depth of the bed rock. Later test holes about 20-ft. sq. were dug to determine more of the geology of the bed rock.

The Philo site was finally chosen and it is on this so-called island that it was decided to build the plant.

There is a dam across the river at the north end of the island. It is about 730-ft. wide and the average head flowing over it is two ft. or more with an average velocity of six second ft. The water is to be used for cooling and condensing purposes. Of course not all of the water flowing over the dam will be used, in fact only a very small portion of it, but it was imperative that the river have a great enough drainage area and volume so that a continuous dry period would not markedly affect the volume of water and cause operations to cease. The Muskingum River has the largest drainage area of any river in the state. Its drainage area is 8037 sq. miles. The Maumee has the next largest drainage area which is 4919 sq. miles.

The Ohio Power Company, a subsidiary of the American Gas & Electric Co., is building this plant. Mr. Emanuel Anderson, a University of Michigan man, is the Superintendent in charge. Mr. Harvey F. Brown '12, one of our own former graduates is in charge of the engineering operations. This is quite a large project and will cost in the neighborhood of \$15,000,000 to complete.

The plant will be one of the most modern and



THE CONDENSER WELL AND A FEW CAISSONS

up-to-date electric power plants in existence. It was designed by the firm of Sargent & Lundy, Consulting and Designing Engineers of Chicago. At the present, a two unit plant is being constructed, 55,000 horse power to the unit. Four additional units of the same horse power each will be built later on. The electricity will be made by generators run by large steam turbines.

The immensity of the plant can be realized by looking at the daily coal consumption. It will be from 2400 to 3000 tons per day. The Ohio Power Company will bring much of it from their own mines, besides buying all the local supply available which is of the proper quality. There is coal in the hills bordering the river, and the mines already in operation are enlarging and making ready to produce as large output as possible. One new Company which has just been incorporated has bought leases covering about 1500 acres of coal land which they plan on opening for supplying coal to the plant.

The plan is to keep on hand about 400,000 tons of coal. About 300,000 tons of this will be stored under water in the canal for use in an emergency such as a coal strike. The regular operating supply will consist of about 100,000 tons, which will be stored on the island. This large supply will thus assure the power consumers, connected up to the extensive system of electric transmission lines in the state of Ohio, of a reliable and continuous supply of electric current. All precautions against non-delivery of coal have been taken, so that the entire power plant of 350,000 horse power can operate for five months without receiving any outside shipments of coal. Most of the coal consumed will be brought up the river by barge from The Ohio Power Company's fields in West Virginia. This will be unloaded at the southern end of the island by a barge unloading device and carried by tramway to the operating supply, from which it will go by a belt conveyor to the hoppers which feed the boilers. The boilers will be Babcock and Wilcox with Cox automatic stokers. Steam will be furnished to the two 55,000 horse power steam

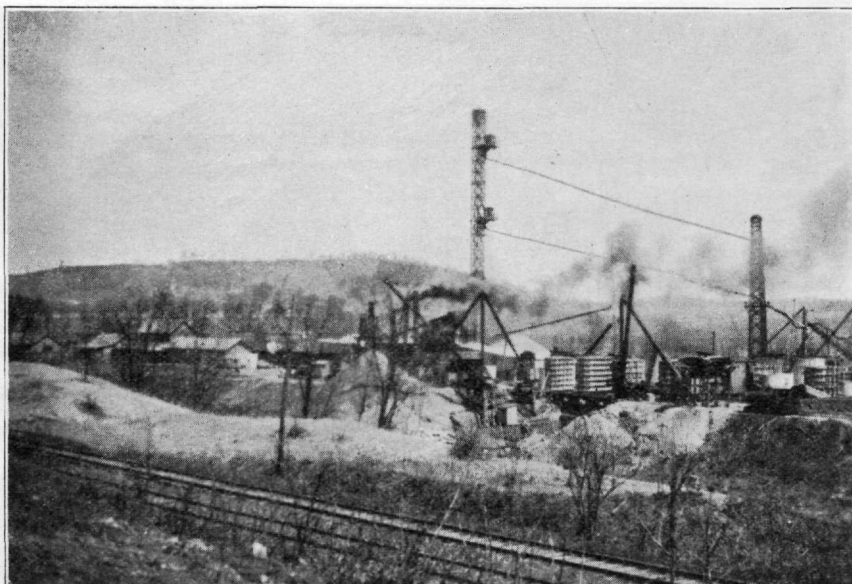
turbines by eight 1500 horse power boilers. The thickness of the boiler plates will be one and three-quarter inches.

The disposal of the cinders is quite a problem. Before it was decided to build the plant at Philo, one of the major things that had to be looked after, was to see that there would be a place to dump them. The Company owns a strip of land both above and below the island on both sides of the river on which they intend to dump their cinders after they fill up the island. The topographic survey included all of this land as well, and a two-ft. contour interval was made over all of it. Unusual difficulty was encountered in finding some of the boundary lines, as some of the deeds of the land dated back rather far, and most all of the monuments had been destroyed.

The Foundation Company of New York has the contract to build the plant and carry on the construction operations. One of the things that had to be done was to re-excavate the old canal and put it in good shape. A head wall and intake gates were constructed at the entrance to the canal, which is at the north end of the island. It might be well to state here that the direction of flow of the river is to the South. The intake water will be taken in from the canal and the flow can be controlled by the gates. At the extreme southern end of the island a dam is being constructed to give sufficient volume of water for the under-water coal storage. The dam will be 26-ft in height above the bed of the canal, about 150-ft. long and 60-ft. wide. On top of the dam will be three railroad tracks going to the plant. The existence of this old canal is quite a factor in this project.

The foundations that carry the steel columns for the main structure are all of the caisson type and go to bed rock, which is about 52-ft. deep. The bed rock is limestone and it is of faulty structure. The soil above the bed rock is all sand and gravel. The caissons are reinforced concrete and there are 110 in the two unit plant. Some of the caissons are round and some are

(Continued on Page 24)



CONSTRUCTION OF INTAKE AT THE OLD CANAL



## NEW PHILO POWER PLANT

(Continued from Page 10)

elliptical. The round ones are 8-ft. in diameter and the elliptical ones are 8-ft. by 20-ft. The method of sinking the caissons was rather an interesting one. The hole was started by an orange-peel bucket and after about 15-ft had been excavated, forms for the first or bottom section were built, but instead of building it as a solid section, it was built as a hollow cylinder with the outside shell or wall about a foot or a foot and a half thick. Then the orange-peel bucket which was used to sink this shell was lowered thru the hollow cylinder and it excavated the ground underneath the shell, thus causing the shell to sink. When this cylinder was down 15-ft., another section was poured and lowered in the same way, the section being united by the reinforcing steel. This method was continued until the bottom section hit bed rock. The finished caissons were later capped with neat cement mortar.

The intake which takes in the water for the condenser is on the edge of the canal. For each two units there are two 6-ft. intake conduits. The water passing through these conduits is controlled by 72-inch motor operated valves. Many other large motor operated valves will be installed, all designed to open and close by merely touching with the finger a small switch.

The Ohio Power Company has taken extra precautions to secure good water for the steam boilers, 500-ft. of 12-in. tile pipe have been placed in the ground in the water bearing strata, which will be pumped into large supply tanks. The ground water thus received is too hard and contains too much scale-forming ingredients. Before the water is passed to the boilers the water is to be treated and softened in a water plant purchased from the William B. Scaife Company. To provide sufficient storage of treated and untreated water, two 100,000-gallon steel tanks will be placed on steel towers over 100-ft. above the ground and connected up to the tanks, where the chemical reaction takes place in treating the raw water.

The condenser well is 70-ft. deep with the bottom 12-ft. filled up solid with concrete. It has an inside diameter of 70-ft. and the walls are 6-ft. thick, thus making the outside diameter 82-ft. Needless to say, this large well is built of reinforced concrete. Besides housing the condensers, it will also support the two 55,000 horse power turbines. Leading from the condenser and deep down in the ground are two 6-ft. discharge conduits which go to the river. In places under the condenser the bed rock had a 2-ft. difference in elevation because of its faulty structure.

The building proper will cover a rather large area. All the floors are reinforced concrete and also all the walls below the basement floor. Above the basement floor the walls will be constructed of common brick. The walls vary in thickness from 19 inches to 32 inches in thickness. The amount of brick required to build the walls is figured at 2,250,000. The inside of the building, the columns, girders and floor beams will all be of structural steel. The total height of the building will be somewhere around 100-ft. The intake

crib and water treatment plants will be of reinforced concrete.

A 1-2-4 mix is being used in the concrete. The sand and gravel comes from the river. It is excavated and washed farther down the river and is brought up to the construction on barges from which it is lifted by clamshell buckets and dumped in a hopper on the bank of the river. An incline leads from this hopper to the mixing plant. The hopper discharges into cars which run on this incline. The cars are pulled up this incline and are dumped at the mixing plant. The capacity of these cars is three cubic yards. The cars are hauled by cable. The incline is about 500-ft. long and about 50 or 60-ft. high at the upper end. Sand is piled on one side of the incline at the mixing plant and gravel on the other side. The concrete tower is 165-ft. high and is by the side of the mixing plant. There is a supporting tower between 300 and 400-ft. away which supports the chutes. Both of these towers are of wooden construction. The pouring was done at two elevations—first, at about 100-ft. up, and then as the work progressed and got higher, the pouring was done at the top of the tower. At both of these elevations are platforms or little houses for the workmen who must be up there for the control of the elevator and the concrete, as it is poured into the chutes. Before beginning a day's pouring, a grout cement was first sent down the chute to get the chutes thoroughly lubricated. The concrete is sent out to the forms by chute, thus covering every part from the one central mixing plant, and necessitating quite a bit of chute, somewhere between one and two thousand lineal ft. altogether.

The American Bridge Company is furnishing and erecting the structural steel. There will be about 4500 tons of structural steel in the building and altogether with the fittings, etc., there will be about 12,000 tons of steel in the building. There will also be about 3,000 tons of steel in the yards.

To handle all the heavy parts of machinery, large traveling cranes 20 and 100 tons lifting capacity, are now being placed in the steel work by the Morgan Engineering Company.

The average elevation of the island is about 688-ft. above sea-level. The elevation of the water that covered the island in the 1913 flood was about 706-ft., thus causing the island to be submerged to a depth of about 18-ft. The plans call for the island to be raised to an elevation of 704-ft. The basement floor will be at an elevation of 708 ft. and the main floor at 730-ft. The turbines are on the main floor and they will be 22-ft. higher than the 1913 flood. Bed rock is at an elevation of around 635-ft. The raising of the island has been started by building a large levee wall along the river side of the island.

The B. & O. Railroad runs right by the island on the other side of the canal. Several additional tracks and switches and turnouts were put in to get the materials of construction to the plant. The mainland is about 20 to 30-ft. higher in elevation than the island and by grading down a spur branch of the railroad was brought on to the island at its southern end. At the north end of the island, three deck plate girder bridges were constructed over the canal to the island,—

(Continued on Page 28)

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### NEW PHILO POWER PLANT

(Continued from Page 24)

one a 75-ft. span bridge, and two 50-ft. span bridges. The railroad will come on to the island over all of these bridges. Then at the extreme southern end of the island are the three tracks on the top of the dam. For the construction work all of the tracks were narrow gage except one, but the narrow gage tracks have all been removed so that now only standard gage are used. There will be a belt line all around the island besides all the other numerous tracks.

To look at the excavation of the canal one might get some idea of what the Panama Canal project was like, for this excavation is quite a project in itself. Not so much excavating has to be done in the upper end of the canal as it does not have to be widened very much, but the southern end has to be widened a great deal. The whole canal has to be deepened and part of it will be 200-ft. or more wide in places and 50-ft. deep from the level of the island. At the northern end of the canal in the part thru which the intake water will flow till it reaches the intake, which is about 1000-ft. the bottom of the canal will be 20-ft. wide, and its sides will have a slope of one and a half to one, thus making the top 68-ft. wide, as the depth is 16-ft. The water will flow thru this 1000-ft. of canal at a velocity of six second ft. It is not planned to line this part of the canal unless it is absolutely necessary. Neither will the under-water coal storage basin be lined unless it also proves necessary to do so. There are numerous steam shovels in the canal and the bottom is full of railroad tracks over which the dirt is hauled to the levee that is being constructed. About 50,000 cu. yds. of earth had to be excavated in the canal. Part of this was done by hydraulic dredge. The total amount of earth to be moved in the whole construction operation will be about 250,000 cu. yds. Altogether for the whole construction program about four miles of railroad track has been put down.

There are about six hundred men employed in the construction and about that many will be

needed to operate the plant after it is built. The Company takes good care of their men. There is a field hospital right on the ground with a doctor and a trained nurse. As mentioned before, The Foundation Company of New York is constructing the plant and they have an enormous amount of equipment on the ground such as derricks without number, steam shovels, locomotives, locomotive cranes, cars, and they have their own fleet on the river, consisting of a steamboat, several steel barges, a sand digger and a derrick boat. The place presents a very active scene, as one might imagine a \$15,000,000 project would. The time required to build the plant is figured at three years, the construction now has been under way for about 14 months.

The power generated will be sent all over south-eastern and northwestern Ohio on high tension lines. The farthest distance to where power will be sent will be to Charleston, West Virginia. A system of transmission towers leading in all directions from the plant has been constructed. These towers are steel and are about 60 to 75-ft. in height. They are placed in the most advantageous spots, without regard to a set distance between them, although, of course, there is a limit that they can be spaced apart. They are generally located on the hilltops. The towers on the island and right across the river are of different design. They have a concrete base on which the steel superstructure rests. This concrete base goes down about 15-ft. It was necessary to make certain that the steel superstructure would be out of water. The tower right at the plant is about 100-ft. high and has a very solid and substantial concrete base. It has lightning arrestors which also are grounded into concrete posts driven deep in the ground. 132,000 volts will be sent over the lines at first, and later the voltage will be increased to 210,000 volts.

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